

DEC STD 080-0 Digital Product Safety Industrial Control Equipment - Introduction and General Requirements

DOCUMENT IDENTIFIER: A-DS-EL00080-00-0000 Rev B1, 28-Mar-1991

ABSTRACT: Defines safety design criteria to be applied to all Digital industrial control equipment.

APPLICABILITY: This standard applies to all products sold by Digital for the industrial control market. Some product areas, such as software, furnishings, or other market areas, may not have applicable requirements within this document. However, general principles of safety still apply. The requirements of this standard apply to all products in Phase 0 or Phase 1 on the date this standard is approved.

STATUS: APPROVED 28-Mar-1991; use VTX SMC for current status.

NOTES

Words in the text of this document shown in all capital letters are defined in the glossary.

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APPROVAL: This standard has been recommended for approval for use throughout Digital by the DEC STD 080 Committee and the General Review group for its category. Rev B1 is a clerical revision to correct referenced documentation errors in rev B.

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1 INTRODUCTION

1.1 PURPOSE

This standard defines safety design criteria to be applied to all Digital INDUSTRIAL CONTROL EQUIPMENT. It includes specific criteria for prevention of hazards, as related to OPERATOR and SERVICE PERSONNEL safety.

The criteria stated in this standard have been derived from:

UL 508, 14th Edition (1984)	<i>Industrial Control Equipment (USA)</i>
CSA 22.2 No. 142-M1987	<i>Process Control Equipment (Canada)</i>
IEC 204-1, 2nd Edition (1981)	<i>Electrical Equipment of Industrial Machines (Europe)</i>
AS 3100 (1982)	<i>Definitions and General Requirements for Electrical Material and Equipment (Australia)</i>

These standards will be referred to as UL 508, CSA 142, IEC 204, and AS 3100 throughout the remainder of this standard.

References to other standards throughout this standard originate from references within the basic UL, CSA, IEC, and AS documents.

1.2 SCOPE

This standard applies to INDUSTRIAL CONTROL EQUIPMENT with a RATED VOLTAGE not exceeding 600 V and designed to be operated continuously under conditions of intended normal use.

This standard specifies requirements intended to ensure safety for the OPERATOR and anyone who may come into contact with the EQUIPMENT and, where specifically stated, SERVICE PERSONNEL, who may be one and the same.

This standard is intended to ensure the safety of installed EQUIPMENT, whether such installed EQUIPMENT consists of a system of interconnected UNITS or independent UNITS, subject to installing and maintaining the EQUIPMENT in the manner prescribed by Digital.

This standard incorporates the most stringent requirements for INDUSTRIAL CONTROL EQUIPMENT from external standards (UL 508, CSA 142, IEC 204, AS 3100) and other results of our own field experience, under the assumption that all EQUIPMENT will be indirectly connected to telecommunications lines.

Conforming to this standard and to other Digital standards referred to in this standard will result in compliance with the requirements for INDUSTRIAL CONTROL EQUIPMENT in all geographical areas in which Digital ordinarily does business. See *DEC STD 119-0 Digital Product Safety - Introduction and General Requirements*.

This standard incorporates some design techniques chosen or used within Digital as preferred construction. These techniques ensure compliance with the referenced standards. The detailed requirements from these referenced standards may not be quoted in this standard.

Some product designs, because of their intended use, may not be covered by the specifics of this standard.

Specifically this standard does not cover:

1. EQUIPMENT intended for operation outside the environmental conditions of Class A, Class B, and Class C as defined in *DEC STD 102-1 Environmental Standard for Computers and Peripherals - Temperature, Humidity, and Altitude Test Requirements*.
2. Support EQUIPMENT such as building air conditioning, fire detection or fire extinguishing systems, power supply systems such as motor generator sets or building BRANCH CIRCUIT wiring, whether supplied by Digital or others.
3. EQUIPMENT for use on IT (impedant NEUTRAL) and TT POWER SYSTEMS.
4. Hazardous area locations as defined by Article 500 in the US National Electrical Code and various other applicable national standards.

Compliance with this standard implies that the design meets the requirements of all relevant sections and, for design features which affect safety and which are not specifically covered, the design is in accord with the general principles set forth in subhead 1.4 Safety Principles.

The need for additional detailed requirements to cope with a new situation should be brought promptly to the attention of Corporate Product Safety and Regulations.

The requirements and tests detailed in this standard are to be considered only if safety is involved. If it is evident from the design of the EQUIPMENT that a particular test is not applicable, the test is not conducted. For those tests deemed not applicable due to other tests or technical reasons, the engineer shall state the rationale used in lieu of test data.

A product that complies with the text of this standard will not necessarily be judged to comply with the standard if, when examined and tested, it is found to have other features that impair the level of safety contemplated by these requirements.

1.3 RESPONSIBILITIES

In keeping with Digital's concern for safety, every Digital employee involved in the design, development, and manufacture of Digital hardware products is to pay special attention to ensure that our products meet the safety requirements established and defined by this standard.

The policy of Digital is to design, manufacture, and maintain safe and reliable products that meet or exceed known safety requirements.

In line with this policy, Digital shall do the following:

1. Design and test its products to these requirements.
2. Use the services of testing organizations, such as Underwriters Laboratory (UL), when appropriate, to ensure compliance with product safety requirements.
3. Make reasonable efforts to keep informed of developments in the field of product safety. Such efforts shall include participation in organizations such as:

CBEMA	Computer and Business Equipment Manufacturers Association
ITAC	Information Technology Association of Canada
ECMA	European Computer Manufacturer's Association
UL IAC	Underwriters Laboratory Industry Advisory Conference

4. Maintain and monitor the necessary information feedback system to determine the safety performance of its products, and react in a responsible manner to any indications of hazardous events.

Specific details around implementation of this policy are provided in EL-00424-00, *Digital Product Safety Handbook*.

1.4 SAFETY PRINCIPLES

1.4.1 General Principles

Safety is considered to be freedom from unacceptable risks. Designers must understand the underlying principles of safety requirements so that they can design safe EQUIPMENT.

The maximum touch voltages and body currents used in this standard and widely used in IEC standards would not necessarily be unnoticed by a person in very poor health, but the chances of such a person experiencing these voltages or currents are assumed to be acceptably low. In general, the requirements are intended to ensure that the EQUIPMENT remains safe in the presence of a single fault.

In addition, requirements are intended to provide at least two independent levels of protection against hazards.

The following principles are not an alternative to the detailed requirements of this standard, but are intended to provide designers with an appreciation of the principles on which these requirements are based.

1.4.2 Hazards

This standard is intended to prevent injury or damage due to the following hazards:

- ELECTRIC SHOCK
- ENERGY HAZARDS
- FIRE and HEAT
- RADIATION HAZARDS
- MECHANICAL HAZARDS
- CHEMICAL HAZARDS

1.4.2.1 Electric Shock

ELECTRIC SHOCK is due to current passing through the human body. Currents of the order of a milliampere can cause a reaction in persons in good health and may cause indirect injury due to involuntary reaction. Higher currents can have more damaging effects. Voltages up to about 42.4 V (peak or dc) are not generally regarded as dangerous under dry conditions, but parts that have to be touched or handled should be at SAFETY EARTH GROUND potential or properly insulated.

There are two types of persons who are normally concerned with INDUSTRIAL CONTROL EQUIPMENT; OPERATORS and SERVICE PERSONNEL. OPERATORS have been trained in the use of INDUSTRIAL CONTROL EQUIPMENT and they understand the general safety practices employed in operating this type of EQUIPMENT. It is assumed that SERVICE PERSONNEL will be reasonably careful in dealing with obvious hazards,

but the design should protect them against mishap by use of shields for hazardous voltage terminals, segregation of MACHINE EXTRA LOW VOLTAGE (MELV), and hazardous voltages, and warning labels if other protection is impractical. More important, SERVICE PERSONNEL must be protected against unexpected hazards.

It is normal to provide two levels of protection for OPERATORS to prevent ELECTRIC SHOCK caused by a fault. Thus, a single fault and its resulting faults will not create a hazard. However, provision of additional protective measures, such as SAFETY EARTH GROUNDING or SUPPLEMENTARY INSULATION, is not considered a substitute for, or a relief from, properly designed BASIC INSULATION.

Table 1: Electric Shock: Cause and Prevention

Cause	Prevention
Contact with parts normally at hazardous voltage.	Prevent operator access to parts at hazardous voltage (or energy levels) by fixed or locked covers, interlocks, and so forth. Discharge capacitors at hazardous voltages.
Breakdown of insulation between parts normally at hazardous voltage and accessible metal.	Either connect the accessible metal to safety earth ground so that the voltage which can develop is limited to a safe value and the circuit overcurrent protection will disconnect low impedance faults; or use double or reinforced insulation between parts normally at hazardous voltages and accessible metal-work, so that breakdown is not likely to occur.
Breakdown of insulation between parts normally at circuits, thereby putting accessible parts at hazardous voltage.	Segregate hazardous and MELV circuits. Separate by safety earth-grounded metal screens or double or reinforced insulation. connect MELV circuits if capable of carrying possible fault currents to safety earth ground.
Breakdown of insulation guarding parts at hazardous voltage.	Insulation for parts at hazardous voltage which is accessible to the operator should have adequate mechanical and electrical strength to eliminate this danger.
Leakage current from hazardous parts to body of Class II equipment. Failure of safety earth ground connection carrying leakage current.	Limit leakage current to body to a safe value, or provide high integrity safety earth ground connection.

NOTE

Leakage current includes current due to RFI filter components connected between primary power circuits and frame.

Movable EQUIPMENT is considered to present a slightly increased risk of shock due to possible extra strain on the supply cord, leading to rupture of the ground conductor and a consequent leakage current hazard. With HAND-HELD EQUIPMENT, this risk is increased, wear on the cord is more likely, and further hazards could arise if the UNITS were dropped.

1.4.2.2 Energy Hazards

Shorting between adjacent poles of high current supplies or high capacitance circuits may cause burns or splashing. Even low voltage circuits may be dangerous in this respect. Protect by separating, shielding, or using safety interlocks.

1.4.2.3 Fire

Temperatures which could cause a fire risk may result from overloads, component failure, insulation breakdown, high resistance or loose connections. However, fires originating within a UNIT should not spread beyond the immediate vicinity of the source of the fire, nor cause damage to the surroundings of the UNIT.

These design objectives should be met by:

- a. Taking all reasonable steps to avoid high temperature which might cause ignition. Controlling the position of combustible materials in relation to possible ignition sources.
- b. Limiting the quantity of combustible materials used.
- c. Ensuring that combustible materials are of low flammability.
- d. Using ENCLOSURES or barriers if necessary to limit the spread of fire within the EQUIPMENT.
- e. Using suitable materials for the outer ENCLOSURES of the EQUIPMENT.

1.4.2.4 Mechanical and Heat Hazards

Requirements are included to prevent injury due to high temperatures of parts accessible to the OPERATOR; to ensure that the EQUIPMENT is mechanically stable and structurally sound; to avoid the presence of sharp edges and points; and to provide adequate guarding of dangerous moving parts. SERVICE PERSONNEL must be protected against unexpected hazards.

1.4.2.5 Radiation Hazards

Radiation from some EQUIPMENT can include radio frequency, sonic, ionizing radiation, infrared or ultraviolet, and high intensity visible and coherent lights, and so forth. Requirements must keep OPERATOR and SERVICE PERSONNEL exposures to acceptable levels.

1.4.2.6 Chemical Hazards

Hazardous chemicals potentially can cause injuries and damage through contact with the material, its vapors and fumes. Where possible, using hazardous chemicals in design will be avoided. If no other design alternatives are available, strict controls including appropriate warning labels are required to limit such contact under normal and abnormal conditions.

1.4.3 Materials

Materials used to construct EQUIPMENT should be selected and arranged such that they can be expected to perform in a reliable manner without a risk of ENERGY HAZARD or ELECTRIC SHOCK developing, and so that the materials would insignificantly contribute to the development of a serious fire hazard. Materials should be applied in ways that do not introduce MECHANICAL, HEAT or CHEMICAL HAZARDS. Reference should also be made to *DEC STD 136-0 Digital Policy on Government-Regulated Materials in Digital Products*.

2 REQUIREMENTS

EQUIPMENT shall be designed and constructed so that, in normal operation and under a foreseeable fault condition, it causes no hazard within the meaning of this standard to persons or surroundings. When a value for measurement is given in this standard it is followed by an equivalent value in other units in parentheses. The second value may be only approximate. The first stated value is the requirement.

Unless indicated otherwise, all voltages and current values mentioned in this standard are root-mean-square (rms).

2.1 PRODUCT APPROVAL

All INDUSTRIAL CONTROL EQUIPMENT for sale by Digital falls under the authority of Product Safety.

All industrial control hardware products and associated documentation shall be reviewed against this standard in accordance with the requirements of Product Safety Standards Policy in subheads 2.1.1 and 2.1.2. The submittal of products for certification to external product safety standards and use of follow-up inspection programs for ongoing product safety control shall be in accordance with the Product Safety Submittal and Certification Policy in subheads 2.1.3 and 2.1.4. See also EL-00424-00, *Digital Product Safety Handbook*.

The policy of Digital regarding product safety standards shall be as follows:

1. All new INDUSTRIAL CONTROL EQUIPMENT must be reviewed and tested to meet the requirements of the latest published revision of DEC STD 080.

NOTE

DEC STD 080 contains the Product Safety Design Criteria and Test Procedure Requirements for Digital Products. Compliance with all sections of DEC STD 080 will ensure compliance with external standards.

2. Existing INDUSTRIAL CONTROL EQUIPMENT must be reviewed and tested to, and meet the latest published revision of DEC STD 080 in accordance with the following:
 - a. As required by third party certification agencies.
 - b. When an ECO is performed to the product and the ECO is one which could affect the safety of the product.
 - c. When the product is value engineered and the value engineering includes a change that could affect the safety of the product.
 - d. When the product is used as part of a new design.
 - e. As required for revisions to DEC STD 080.
3. Product safety review and test of new products and Engineering Change Orders (ECOs) is the responsibility of product management and the engineering groups which own the products. Exception: If an existing product is used as part of a new product, product management and the engineering group responsible for the new product must determine the compliance status of the existing product. If the existing product is non-compliant, they will be responsible for the review, retest and any necessary revision of that product or the selection of a comparable existing product which is compliant.

2.1.1 Guidelines for Interpretation

The following guidelines are provided to ensure clarity in the interpretation of the product safety standards policy and to furnish the background information needed to implement the policy properly.

1. Existing products must be reviewed against the latest published revision of DEC STD 080 when a product is valued engineered or when an ECO is performed to the product, and the ECO is one which could affect the safety of the product. ECOs which will most likely affect the safety of the product are ECOs involving any of the following:
 - a. Primary circuit COMPONENTS (line filter, CIRCUIT BREAKER, switch, fuse, fuse holder, and so forth) or controlled COMPONENTS.
 - b. A primary power circuit board.
 - c. A power supply transformer.
 - d. The electrical rating of a COMPONENT.
 - e. The construction of an ENCLOSURE.
2. If an ECO is performed to a product and the ECO is one which could affect the safety of the product, only that portion of the product which is likely to be affected must be reviewed against the latest published revision of DEC STD 080. The remainder of the product will be under control through the review of all existing products to each revision of the standard.
3. The process for the review of existing products to support agency mandated changes is as follows:
 - a. The Corporate Product Safety and Regulations Group will determine the critical new requirements which have been added to the standard and provide a list of those requirements to the Manufacturing Plant Product Safety Coordinators (PPSCs).
 - b. Each PPSC will review all existing products in their plant to determine their compliance status to the new requirements.
 - c. If there is need for a change, the PPSC will give that information to the engineering group responsible for the product. That engineering group is responsible for the implementation of the change(s).
 - d. The engineering product safety group which supports the responsible engineering group will then perform the necessary review and test, update documentation as necessary, submit changes to external agencies, and update the product's Certificate of Compliance.
 - e. The Manufacturing Product Safety and Regulations Manager will inform the Corporate Product Safety and Regulations Manager of any products which have not been brought under compliance with agency requirements.
 - f. The Corporate Product Safety and Regulations Manager will communicate the compliance status of Digital products to the external agencies.

2.1.2 Product Safety Submittal and Certification Policy

The policy for Digital regarding the submittal of products for certification to external product safety standards and use of follow-up inspection programs for ongoing product safety control is as follows:

1. All products marketed or sold by Digital or its subsidiaries shall be:
 - a. Submitted to and approved by appropriate external agencies and/or test houses.
 - b. Controlled through external follow-up inspection program(s).

NOTE

At least one external agency approval of the product and its variants is required.

2. Compliance verification of this policy shall be in accordance with the following Digital Standards:
 - a. *DEC STD 060-0 Design of Hardware Products to National and International Regulations and Standards, Policies and Procedures*
 - b. *DEC STD 062-0 Product Submittal to Regulatory Agencies*
3. The requirements for submittals of Digital products to external agencies and/or test houses and follow-up inspection programs by external agencies and/or test houses are shown in Table 2. Submittals of Digital products to external agencies or test houses or arrangements for follow-up inspection programs other than those listed in Table 2 must be approved by the Digital Product Safety Management Committee (PSMC).
4. External agency submittals for EIC (Enterprise Integration Centers) Category A and Category B products are governed by this Product Safety Submittal and Certification Policy. External agency submittals for EIC Category C products are governed by EIC Engineering Procedure NO. YO-B107R-00, *Engineering Product Safety Procedure*.

2.1.3 Guidelines for Submittal and Certification

1. The product submittals and follow-up inspection programs appropriate for each country where Digital markets its products are shown in Table 2. UL and CSA certifications are required at both the option and cabinet level. IEC certifications are required at the option level. Cabinet level IEC certifications are optional, but recommended if all options are approved by the same certification agency. An option, in this sense, is any product which is intended for desk top use or for installation in a Digital supplied cabinet.
2. Requirements for product submittals and follow-up inspection programs are both regulatory and market-driven requirements.
3. If a product meets the requirements of all countries by having variants for the different countries, each variant has to be submitted, approved and controlled by the appropriate external agency(ies) for those countries only.

NOTE

The requirements included in this policy are in addition to the requirement for all new products to meet DEC STD 080 in accordance with the product safety standards policy.

4. A Product includes:

Hardware	Prints	Sales/Marketing Literature
Software	Packaging	
Manuals	Accessories	

Table 2: Requirements For Product Safety Submittal and Follow-up Programs by Country

Country	Submittal	Follow-up	Description
U.S.	UL Listing or Recognition for Industrial Control Equipment	UL	Stand-alone products shall be submitted for UL Listing. Products sold only as part of another product shall be submitted for UL recognition.
Canada	N/A CSA Model Certification for Process Control Equipment	CSA Category Certification CSA	A product shall only be submitted for CSA Model Certification if the plant in which it will be manufactured is not CSA Category Certified.
Algeria, Australia, Austria, Belgium, Denmark, Egypt, Finland, France, Germany, Holland, Ireland, Israel, Italy, Japan**, New Zealand, Norway, Portugal, Spain, Saudi Arabia, Sweden, Switzerland, UK	Certification to IEC 204 by TÜV, or VDE, or BSI, UL, or CSA.	Follow-up by applicable agency.	Products shall be submitted to one of the agencies or test houses listed for certification to IEC 204. Submittals to more than one of the agencies or test houses listed for certification to IEC standards shall be at the discretion of the Product Manager.

** For Japan, certification to IEC 204 is preferred, but certification to UL 508 is also acceptable.

2.1.4 Software

Software may in some cases have an impact on safety. In such cases, if specific requirements in DEC STD 080-1 are not applicable, the general principles of safety in subhead 1.4, shall apply.

NOTE

Methods of implementation are under consideration.

2.1.5 DEC STD 080 Committee

The DEC STD 080 committee handles the following issues:

1. Requests for interpretation.
2. Proposals for new requirements.
3. Waivers for existing requirements per *DEC STD 066-2 Waivers to Digital Design Standards*.
4. Presentations about specific requirements.
5. Approval of new revisions of DEC STD 080 per *DEC STD 001-0 Management of Technical Standards and Related Documentation*

The committee charter and list of current members are contained in EL-00424-00, *Digital Product Safety Handbook*.

2.2 PROTOTYPE PRODUCTS

The following requirements apply to PROTOTYPE EQUIPMENT, pilot run products and other prototypes which have not completed the safety review process and have not obtained necessary certifications. Exceptions to this include products such as engineering prototypes that will remain with the group that made them. This subhead is not a waiver of safety construction requirements.

Any known hazards must be corrected and products must comply with local laws.

- Prototype products or product lots leaving the company must be reviewed by Product Safety.
- Customers or others, such as operators at trade shows and software development houses, receiving PROTOTYPE EQUIPMENT shall be made aware of its safety status.
- Such EQUIPMENT shall bear the label specified in DEC STD 178-3, subhead 11.30 Prototype Equipment. Additional issues may need to be pursued which are not covered by this standard such as legal contracts, insurance, customer agreements, and so forth.
- At the end of the field test period, this EQUIPMENT shall:
 - a. Be returned to Digital; or,
 - b. Be upgraded to the condition of regular production EQUIPMENT with regard to safety aspects and be acceptable to Customer Services for further maintenance; or,
 - c. Be examined and approved by a Product Safety Engineer (this may occur before shipment to the customer) and be acceptable to Customer Services for further maintenance.

The Product Manager shall be responsible for knowing the quantity and location of PROTOTYPE EQUIPMENT, both in-house and outside, in the event that recall for safety purposes is later required. If the above cannot be complied with, then the Law Department must be involved and a waiver per *DEC STD 066-2 Waivers to Digital Design Standards* is required.

APPENDIX A REFERENCED DOCUMENTS

A.1 EL-Class Digital Documents

EL-Class Number	Document Title
EL-00001-00	<i>DEC STD 001-0 Management of Technical Standards and Related Documentation</i>
EL-00002-00	<i>DEC STD 002-0 AC Power Wiring, Safety Earth Grounding, Plugs and Receptacle Information and Requirements</i>
EL-00053-00	<i>DEC STD 053-0 Interface Between Data Circuit-Terminating Equipment and the Public Switched Telephone Network (PSTN) in the United States and Canada</i>
EL-00053-01	<i>DEC STD 053-1 Interface Between Data Circuit-Terminating Equipment and the Public Switched Telephone Network (PSTN) - Worldwide</i>
EL-00060-00	<i>DEC STD 060-0 Design of Hardware Products to National and International Regulations and Standards, Policies and Procedures</i>
EL-00062-00	<i>DEC STD 062-0 Product Submittal to Regulatory Agencies</i>
EL-00064-00	<i>DEC STD 064-0 Compliance with International Language Requirements</i>
EL-00066-02	<i>DEC STD 066-2 Waivers to Digital Design Standards</i>
EL-00102-01	<i>DEC STD 102-1 Environmental Standard for Computers and Peripherals - Temperature, Humidity, and Altitude Test Requirements</i>
EL-00119-00	<i>DEC STD 119-0 Digital Product Safety - Introduction and General Requirements</i>
EL-00122-00	<i>DEC STD 122-0 AC Power Line Standard: Design Requirements and Guidelines</i>
EL-00136-00	<i>DEC STD 136-0 Digital Policy on Government-Regulated Materials in Digital Products</i>
EL-00178-03	<i>DEC STD 178-3 Digital Marking Requirements for Completed Products Intended to Be Sold</i>
EL-00178-05	<i>DEC STD 178-5 Marking Symbolology</i>
EL-00424-00	<i>Digital Product Safety Handbook</i>
EL-MF119-02	<i>Manufacturing Procedure for Production Testing of X-Radiation</i>
EL-PS405-00	<i>Chemical Products for Sale by Digital Equipment Corporation</i>

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A.2 Other Digital Documents

Document Number	Document Title
YO-B107R-00	<i>Engineering Product Safety Procedure</i>

A.3 Other Documents

Document Number	Document Title
ANSI C96.1	<i>Temperature Measurement Thermocouples</i>
AS 3100	<i>Definitions and General Requirements for Electrical Material and Equipment</i>
ASTM E162	<i>Test For Surface Flammability of Materials - Test for Surface Flammability of Materials Using a Radiant Heat Energy Source</i>
CSA 22.2 77 M1988	<i>Motors with Inherent Overheating Protection</i>
CSA C22.2 142 M1987	<i>Process Control Equipment (Canada)</i>
IEC 204-1	<i>Electrical Equipment of Industrial Machines</i>
IEC 328	<i>Specifications for Switches for Appliances</i>
NFPA 70 - 1984	<i>National Electrical Code</i>
NFPA 75 - 1984	<i>National Electrical Code</i>
UL 1439	<i>Determination of Sharpness of Edges on Equipment</i>
UL 508	<i>Industrial Control Equipment (USA)</i>
UL 508 SUPPLEMENT B	<i>Investigation of Component Coatings</i>
UL 746C	<i>Standard for Polymeric Materials - Use in Electrical Equipment Evaluations</i>
UL 83	<i>Thermoplastic Insulated Wire and Cables</i>
UL 94	<i>Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances</i>

A.4 Ordering Information

Following are the sources for documents not available from Standards and Methods Control.

- EIC Engineering Procedure No. YO-B107R-00
Obtain from EIS Engineering Quality Assurance and Standards
DTN: 264-6565 or 264-6219
- ANSI, IEC, and ISO Documents
American National Standards Institute (ANSI),
1430 Broadway, New York, NY 10018,
Telephone (212) 354-3300 x479
- American Society for Testing and Materials (ASTM),
1916 Race Street,
Philadelphia, PA 19103
- Canadian Standards Association (CSA), Standards Sales,
178 Rexdale,
Ontario, Canada M9W1R3,
Telephone (416) 744-4044
- National Fire Protection Association (FPA),
Batterymarch Park, Quincy, MA 02269,
Attention Publications Sales Division,
Telephone (617) 328-9230

- Underwriters Laboratories (UL), Publications Stock,
33 Pfingsten Road, Northbrook, IL 60062,
Telephone (312) 272-8800, x2612 or x2622

APPENDIX B RELATED DOCUMENTS

B.1 EL-Class Digital Documents

EL-Class Number	Document Title
EL-00102-03	<i>DEC STD 102-3 Physical Stability Requirements During Shipping and Handling</i>
EL-00176-00	<i>DEC STD 176-0 Printed-Wiring Board Acceptance Criteria</i>
EL-00178-07	<i>DEC STD 178-7 Translations</i>

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B.2 Other Documents

Document Number	Document Title
ANSI/UL 1418 - 1981	<i>Standard for Implosion-Protected Cathode-Ray Tubes</i>
ASTM E84	<i>Surface Burning Characteristics of Building Materials</i>
CSA 22.2 0	<i>General Requirements Canadian Electric Code Part II</i>
CSA 22.2 0.4	<i>Bonding and Grounding of Electrical Equipment</i>
CSA 22.2 111 M1986	<i>General Use Switches</i>
CSA 22.2 127	<i>Equipment Wires</i>
CSA 22.2 14 M1985	<i>Industrial Control Equipment</i>
CSA 22.2 24 M1981	<i>Temperature-Indicating and Regulating Equipment</i>
CSA 22.2 43 M1984	<i>Lampholders</i>
CSA 22.2 55 M1986	<i>Special Use Switches</i>
CSA Z65	<i>Radiation Hazards From Electrical Equipment</i>
IEC 309	<i>Plugs, Socket-Outlets and Couplers for Industrial Control Equipment</i>
UL 547	<i>Thermal Protection</i>
UL 723	<i>Tests for Surface Burning Characteristics of Building Materials</i>

B.3 Ordering Information

Following are the sources for documents not available from Standards and Methods Control.

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GLOSSARY

For the purpose of this standard, the following definitions apply.

access area: See operator access area, service access area.

actuator: Part of the actuating system of a control device to which an external actuation force is applied, for example, a handle, knob, push button, roller, or plunger.

basic insulation: Insulation applied to live parts to provide basic protection against electric shock.

body : All conductive parts, shafts of handles, knobs, grips and the like in operator and service access areas, and metal foil in contact with all surfaces of insulating material in operator access areas.

branch circuit: That portion of the building wiring system beyond the final overcurrent device on the power distribution panel protecting the circuit to the field-wiring terminals in a permanently connected unit or to the receptacle outlet for cord-connected units.

chemical hazard: A hazard where personal injury or illness by inhalation, ingestion, or absorption of chemicals and materials can occur. Any solid, liquid, or gas, either by itself or produced as a result of some reaction from another chemical, light, heat, and so forth, that results in personal injury or illness is considered a chemical hazard.

circuit breaker: A device designed to open or close a circuit manually and to open the circuit automatically on a predetermined overload of current.

class I (IEC) equipment: Equipment in which protection against electric shock does not rely on basic insulation only, but includes an additional safety precaution in that conductive parts in operator and service access areas are connected to the safety earth grounding conductor in the fixed wiring of the installation in such a way that the accessible conductive parts cannot become hazardous in the event of a failure of the basic insulation. Class I equipment may have parts with double insulation or reinforced insulation, or parts operating at machine extra-low voltage (MELV). For equipment intended for use with a flexible cord, this provision includes a protective conductor as part of the flexible cord. Electric shock does not rely on basic insulation only, but in which additional safety precautions, such as double insulation or reinforced insulation, are provided, there being no provision for safety earth ground or reliance upon installation conditions.

NOTE

UL and CSA have not yet completed arrangements for approval of Class II data process equipment. For the moment, Class II construction is being approved under the office equipment standards. As a result, some differences in requirements may apply. Design groups should consult with product safety if planning design of such equipment.

Such equipment may be of one of the following types:

- a. Equipment having a durable and substantially continuous enclosure of insulating material that envelops all conductive parts, with the exception of small parts, such as nameplates, screws and rivets, which are isolated from live parts by insulation at least equivalent to reinforced insulation; such equipment is called insulation-encased Class II equipment.
- b. Equipment having a substantially continuous metal enclosure, in which double or reinforced insulation is used throughout; such equipment is called metal-encased Class II equipment.
- c. Equipment that is a combination of the above two types.

NOTE

Do not confuse this with class 2 circuits as defined in the U.S. National Electrical Code.

clearance distance: The shortest distance between two conductive parts, or between a conductive part and the bounding surface of the equipment, measured through air.

NOTE

The bounding surface is the outer surface of the enclosure considered as though metal foil were pressed into contact with accessible surfaces of insulating material.)

component: Constituent part of the electrical equipment, usually specified by function, but used in various applications, such as resistors, capacitors, transistors, integrated circuits, circuit boards, and transducers.

conduit: Tubular duct having rigid or flexible walls made of metal or insulating material.

continuous operation: Operation under normal load for an unlimited period.

control gear assembly: Combination of one or more switching devices together with associated control, measuring, protective and regulating equipment, completely assembled with all the internal electrical and mechanical interconnection, supporting structures and enclosures.

controlled environment: An indoor location where the temperature and humidity are controlled and which is not normally subject to dampness, but where occasional condensation may occur.

control circuit: Circuit used for the operational control of the machine and for protection of the power circuits.

NOTE

Circuits supplying magnetically operated valves and clutches may be considered to be part of the control circuit.)

control device: Device connected into the control circuit and used for controlling the operation of the machine, such as position sensor, manual control switch, relay, and magnetically operated valve.

cord-connected unit: A unit intended for connection to the branch-circuit power line by means of a supply cord.

creepage distance: The shortest path between two conductive parts, or between a conductive part and the bounding surface of the equipment, measured along the surface of the insulation.

data processing equipment: Electrically operated units that separately, or assembled in systems, accumulate, process and store data. Acceptance and divulgence of data may or may not be by electronic means.

detachable power supply cord: A flexible cord, for supply purposes, intended to be connected to the equipment by means of a suitable appliance coupler.

disconnect device: A means used to manually remove the equipment from the electric branch circuit supply for servicing. This includes switches identified to remove power.

double insulation: Insulation comprising both basic insulation and supplementary insulation. See also Class II equipment.

duct: Any channel for holding and protecting electrical conductors used solely for this purpose.

earth: The international equivalent term for the word ground. The terms are used interchangeably. For the purpose of this standard, the term safety earth ground will be used.

electric shock: See shock hazard in this glossary.

electronic equipment: That part of the electrical equipment containing circuitry whereby conduction of electrons takes place through a vacuum, gas, or semiconductor.

NOTE

Some examples of electronic equipment are:

- a. **Devices with semiconductors.**
- b. **Indicating devices such as gauging and feedback units.**
- c. **Static control units and equipment.**
- d. **Magnetic amplifiers and saturable reactors.**
- e. **Industrial data processing equipment.**
- f. **Equipment and units associated electrically and mechanically with the electronic circuits (transducers, low-current electromagnetic relays, transformers, resistors, potentiometers, position sensors, and servo components).**

enclosure: A construction which protects against hazards as defined in this standard (see subhead 1.4). The construction may be an integral part of a component, a separate part of the component, the outer cabinet, or a part of the outer cabinet.

energy hazard: A hazard that exists at any conductive part of a piece of equipment if, between that part and an adjacent conductive part of different potential, there exists a potential of 2 volts or more and either an available continuous power level of 240 volt-amperes or more, or a reactive energy level of 20 joules or more.

equipment: Hardware including firmware - also see Class I, Class II, data processing, hand-held.

exposed conductive part: Conductive part which can readily be touched and which is not a live part but which may become alive under fault conditions. Identical with sub-clause 3.20 of IEC publication 364-1, second edition, 1972.

field-wiring terminal: A terminal to which a supply or other wire that does not have a factory prepared termination is intended to be connected by an installer in the field using commonly available tools.

functional extra-low voltage (FELV): A voltage between conductors or between a conductor and safety earth ground not exceeding 30 V rms ac (42.4 V peak or dc) existing in a secondary circuit which does not meet the requirements for a MELV circuit, nor those for a limited current circuit.

NOTE

The above definition is in accordance with CSA 142, not per IEC 204-1.)

grounded conductor: See neutral.

hand-held equipment: Movable equipment intended to be held in the hand during normal use.

heat hazard: (hot surface) - A hazard where contact with the surface of an assembly or component will either expose an operator to first degree burns or service personnel to second degree burns.

industrial control equipment: The application of digital computers and associated equipment to industrial problems, through the classification, sorting, storing, and manipulation of information, where defined either by the design of the product or the marketing concept of the product.

IT power system (impedance to earth ground): A power distribution system having no direct connection to safety earth ground, the exposed conductive parts of the electrical installation being safety earth-grounded. See also *DEC STD 122-0 AC Power Line Standard: Design Requirements and Guidelines*.

NOTE

Digital's equipment is not designed for use on IT or TT power systems, since primary to safety earth ground voltages may exceed normal values by a factor of two, and safety earth ground faults may result in very high leakage currents without shutting down the system.)

live part: Metal or other conductive parts that, in normal use, have a potential difference with respect to safety earth ground or any other conductive part.

machine extra-low voltage (MELV): A voltage not exceeding 25 V ac or 60 V dc, existing in a circuit which is conductively-connected to a primary circuit, is considered to be a hazardous voltage unless the requirements for a limited current circuit are met.

marking: Signs or inscriptions for identification of the type of a component or device, attached by the manufacturer of the component or device.

mechanical hazard: A hazard where personal injury can occur from the physical construction of the equipment; such as the presence of sharp edges, inadequate guarding of hazardous moving parts, or unstable equipment.

neutral: The primary power conductor carrying operating load current which is connected to safety earth ground potential at the primary power source. This conductor is normally specified as the neutral conductor and must be treated as a live conductor for the purposes of insulation and spacing.

NOTE

Due to risks of misunderstanding, the term grounded conductor will not be used, but instead be described as the neutral conductor referenced to safety earth ground.)

non-detachable power supply cord: A flexible cord, for supply purposes, fixed to or assembled with the equipment.

normal load: The mode of operation which approximates as closely as possible the most severe conditions of normal use in accordance with the manufacturer's user instructions except when the conditions of actual use can obviously be more severe than the maximum load conditions recommended by the manufacturer, in which case a reasonable load is applied.

open equipment: Industrial controls with incomplete or partial enclosures are considered as open devices with respect to the performance requirement in this standard.

operator: A person trained in the use of industrial control equipment. They understand the general safety practices employed in operating this type of equipment. See operator access area, and operator servicing.

operator access area: Any area to which access may be gained without the use of a tool, or any area for which the means of access is deliberately provided to the operator.

operational insulation: Insulation applied between live parts of different potential and which is necessary for the correct operation of the equipment.

operational maintenance: Maintenance performed by persons other than those trained to maintain and service the equipment. It includes such things as inspecting or marking records, changing charts, adding ink and altering control setting. It does not include maintenance that is normally performed by qualified service personnel familiar with the construction and operation of the apparatus and the hazards involved, such as cleaning slide wires, locating causes of faulty performance and replacing parts.

operator servicing: Service that can be performed by personnel other than those trained to maintain the particular unit. Some examples of operator servicing follow:

- a. The attaching of accessories by means of attachment plugs and receptacles or by means of other separable connectors.
- b. The changing of tapes or ribbons that do not involve complicated operations.

NOTE

Changing ribbons is to be considered the function of service personnel rather than operator servicing if the act involves disassembly of the machine.

- c. The replacing of recording tapes, disks, program boards, punched cards, or paper forms.
- d. The replacement of lamps and fuses and resetting of circuit breakers located in an operator access area unless the lamps, fuses, and/or circuit breakers are marked to indicate replacement or resetting only by qualified service personnel.
- e. The making of routine operating adjustments necessary to adapt the unit for its different intended functions.
- f. Routine cleaning. Also removal of jams of data-handling media.

power supply cord: See detachable, non-detachable.

power systems: See IT, TT. See also DEC STD 122.

primary circuits: The wiring and components that are conductively-connected to the supply circuit.

primary-circuit power: Power derived from a branch-circuit power line or from an ac or dc motor/generator set installed separately from or included as a part of a unit or system is primary-circuit power.

printed cable: The finished combination of conductive paths in one or several layers within a flexible strip of insulating material.

printed-wiring assembly: A printed-wiring board on which mechanical and electrical parts are mounted.

printed-wiring board: The finished combination of a pattern of conductive paths either on, in, or both on and in (multilayer) a sheet of insulating material.

protective conductor: Conductor used for some protective measures against shock in case of a fault and for connecting exposed conductive part with:
Other exposed conductive parts.
Extraneous conductive parts (which are not part of the electrical equipment).
Earth electrodes and earthed conductor or an earthed live part, such as a neutral. Identical with sub-clause 3.23 of IEC publication 364-1, second edition, 1972.

protective circuit: The whole of the protective conductors and conductive parts participating in protection against the consequences of earth-faults.

prototype equipment: Equipment that is a preproduction model of a product intended for evaluation prior to production.

radiation hazard: A hazard where personal injury or illness can occur from unacceptable emission and propagation of waves or particles; such as light, sound, electromagnetic, or particles emitted by radioactivity.

rated current: The input current of the equipment as declared by the manufacturer.

rated frequency: The primary power frequency as declared by the manufacturer.

rated frequency range: The primary power frequency range as declared by the manufacturer, expressed by its lower and upper limits, excluding tolerances.

rated operating time: The operating time as assigned to the machine by the manufacturer.

rated voltage: The primary power voltage (for 3-phase supply, the phase-to-phase voltage) as declared by the manufacturer.

rated voltage range: The primary power voltage range as declared by the manufacturer, expressed by its lower and upper limits, excluding tolerances.

reinforced insulation: A single insulation system providing a degree of protection against electric shock equivalent to double insulation under the conditions specified in this standard. The term "insulation system" does not imply that the insulation must be in one homogeneous piece. It may comprise several layers which cannot be tested as supplementary or basic insulation.

safety circuit: Any primary circuit or secondary circuit that is relied upon to reduce risk of fire, electric shock, or personal injury, or risk from electrical energy-high current levels. An interlock circuit, for example, is to be considered a safety circuit.

safety earth-grounded conductor: See neutral.

safety earth grounding conductor: See safety earth ground conductor.

safety earth ground conductor: That conductor or group of conductors which forms the path from the external branch circuit safety earth ground point to the primary safety earth ground terminal of the product. This is usually the green/yellow conductor in the power cord.

safety interlock: A means of preventing access to a hazardous area until the hazard is removed, or automatically removing the hazardous condition when access is gained.

service access area: An area to which operators have no access but where it is necessary for service personnel to have access for maintenance purposes with the equipment switched on.

service personnel: A person with technical knowledge or sufficient experience to enable them to avoid dangers which electricity may create (engineers and technicians and skilled tradesman).

shock hazard: A risk of electric shock is considered likely to occur at any part if the potential between the part and safety earth ground or any other accessible part is more than 42.4 volts peak and the continuous current flow through a 1500-ohm resistor exceeds 3.5 mA.

supplementary insulation: Independent insulation applied in addition to basic insulation in order to ensure protection against electric shock in the event of a failure of the basic insulation.

supply connections: The electrical connections that are made in the field when the equipment is installed.

switching device: A device designed to make or break the current in one or more electrical circuits.

tool: Any object that may be used to operate a screw, latch or similar fixing means.

transient limiting: A component or assembly that limits the transient, such as an overvoltage protective device, a transformer with isolated windings, or a damping impedance suitably located.

TT power system: A power distribution system having one point directly safety earth-grounded, the exposed conductive parts of the installation being connected to safety earth ground electrodes.

NOTE

Digital's equipment is not designed for use on IT or TT power systems, since primary to safety earth ground voltages may exceed normal values by a factor of two, and safety earth ground faults may result in very high leakage currents without shutting down the system.

unit: A portion of a data processing system comprising one or more subsystems in an assembly which includes a supporting structure and a partial or complete enclosing structure, and can be identified by the manufacturer's marking.

working voltage: The voltage to which the part under consideration is subjected when the equipment is operating at its rated voltage under conditions of normal use.

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